

University of Washington experimental west-wide seasonal hydrologic forecast system

Andrew W. Wood
Dennis P. Lettenmaier

Department of Civil and Environmental Engineering
University of Washington

For presentation at

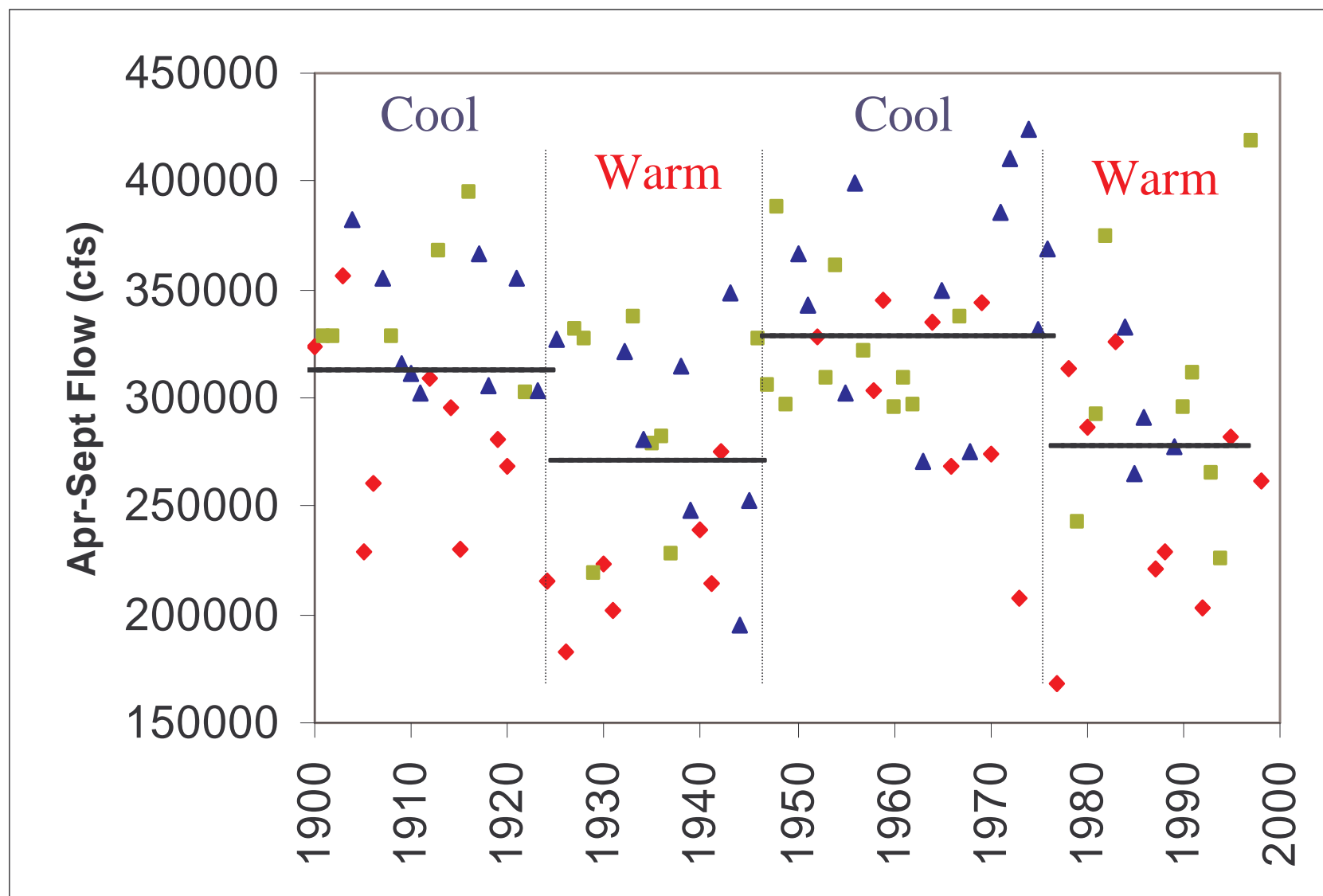
NWD Office of Hydrologic Development
January 27, 2005

National Centers for Environmental Prediction
January 28, 2005

Talk outline

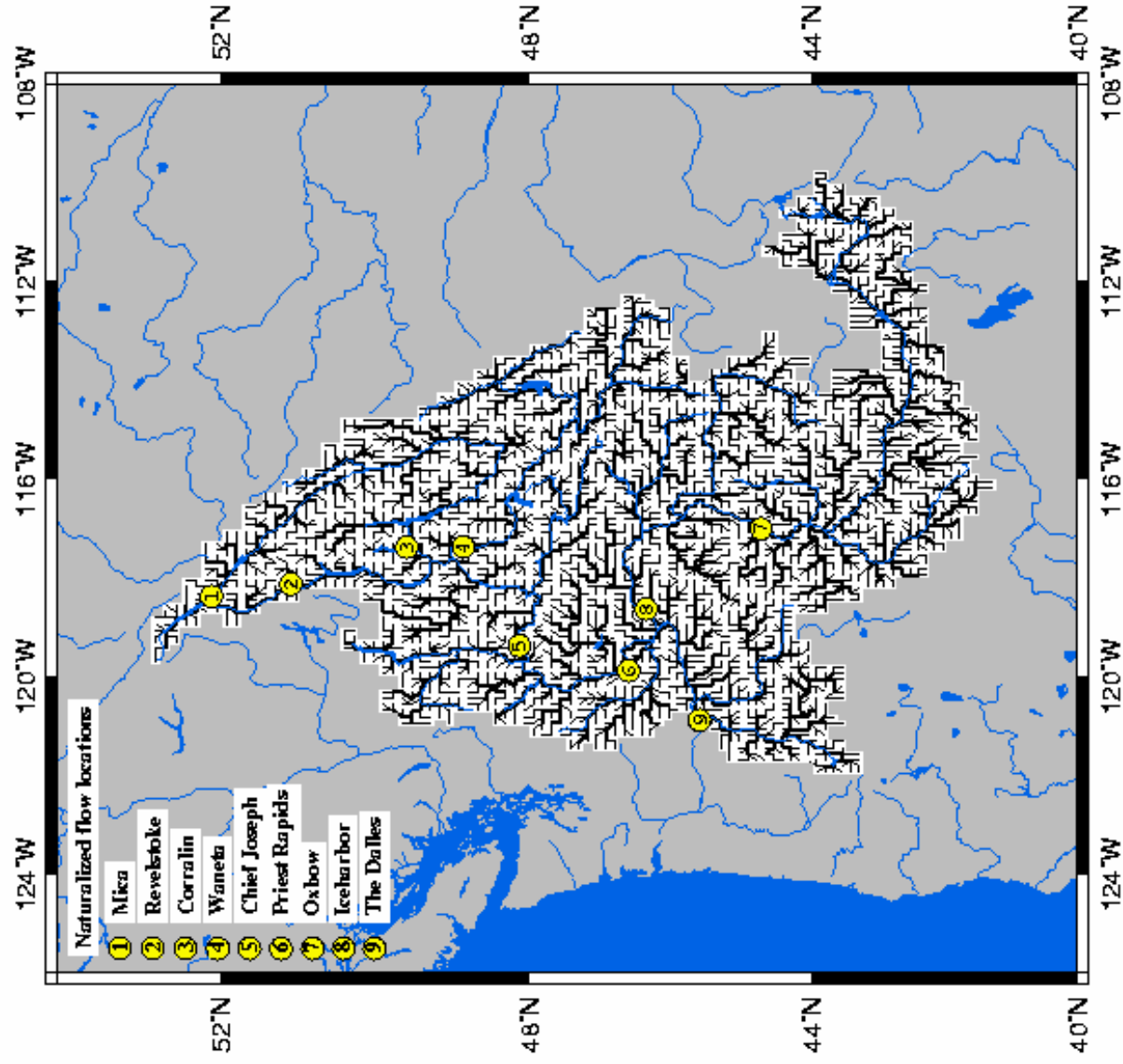
- Intro and motivation (DPL)
- Technical basis and background (AWW)
- Wrapup, opportunities for collaboration (DPL)

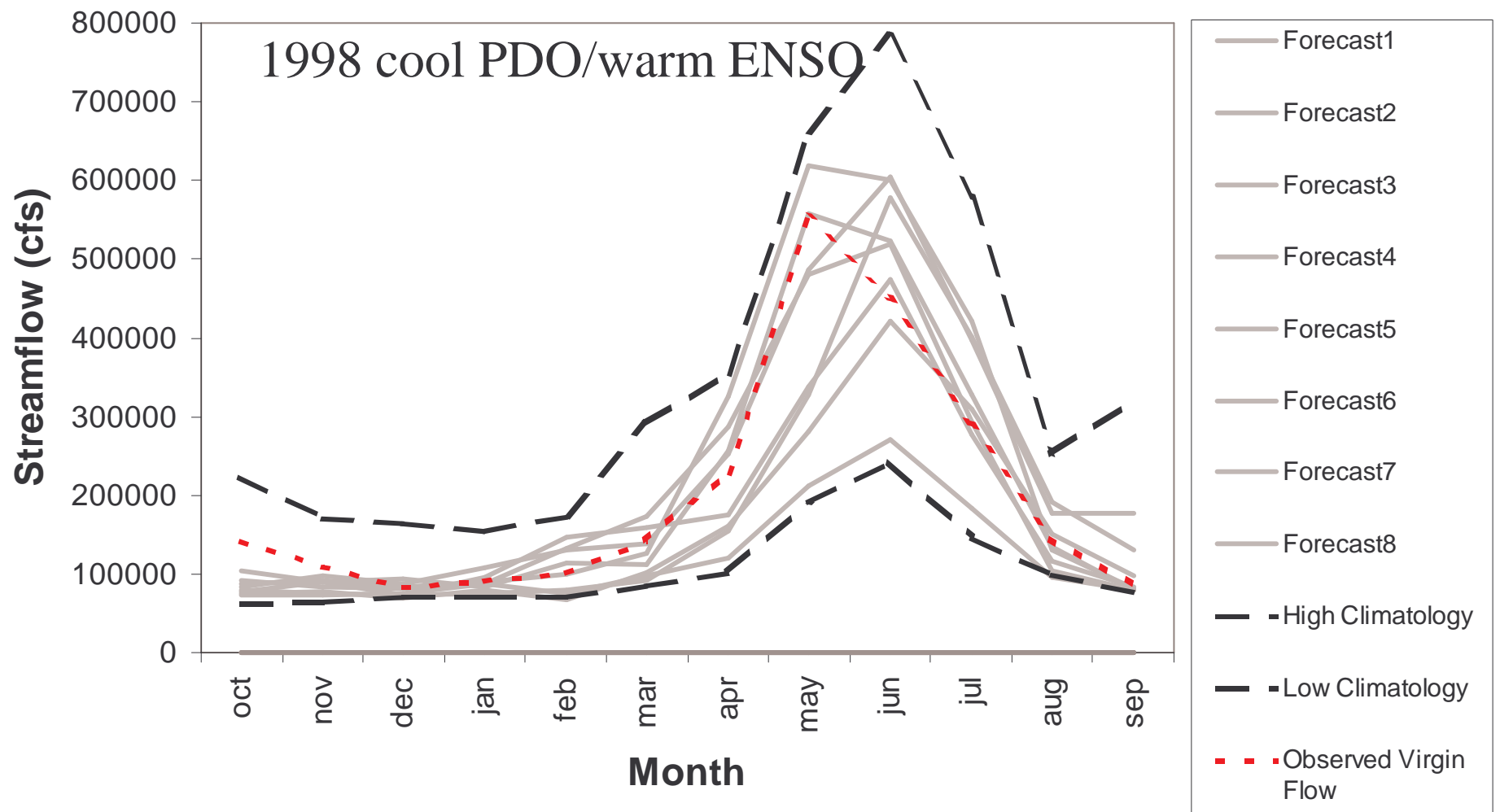
Effects of the PDO and ENSO on Columbia River Summer Streamflows

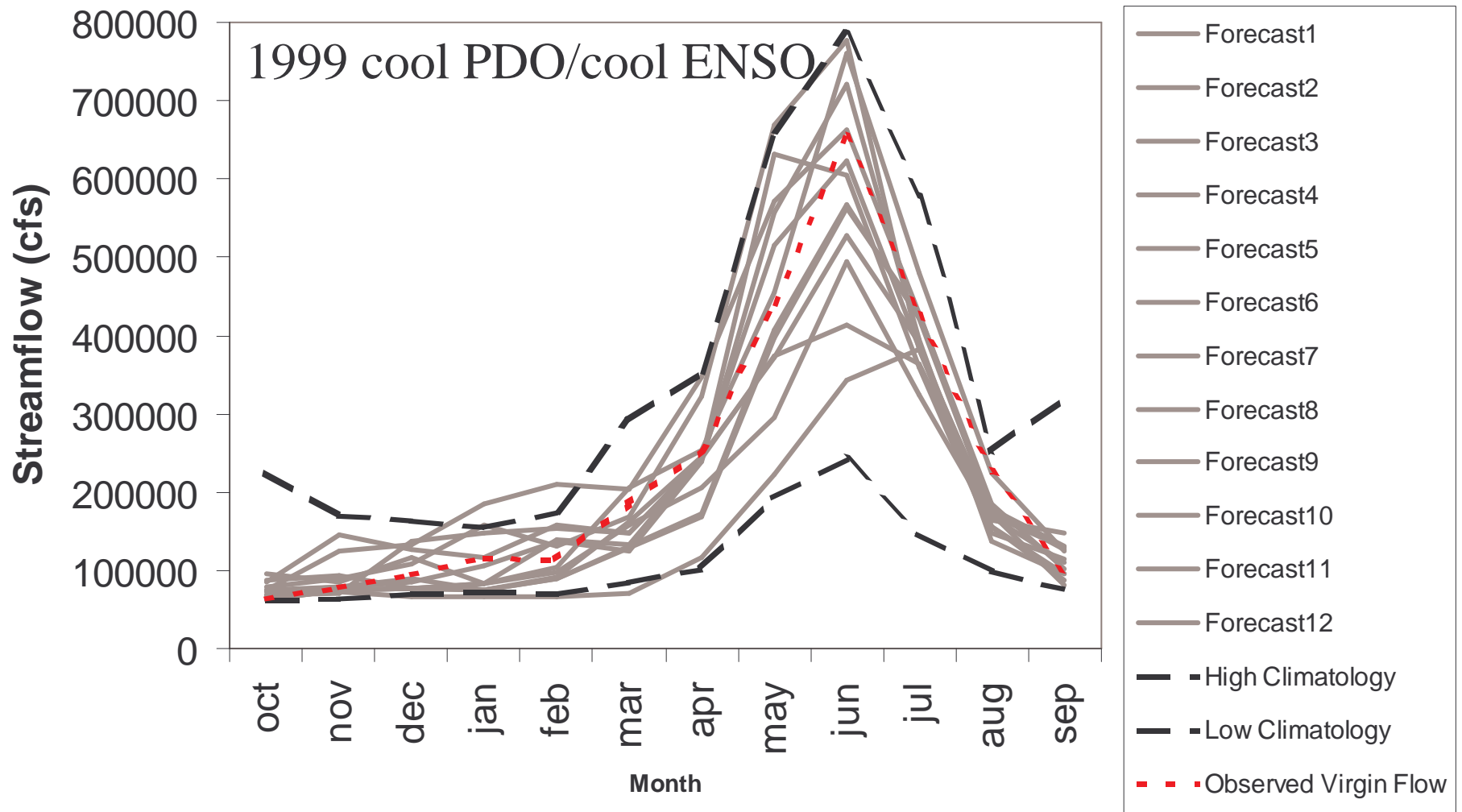


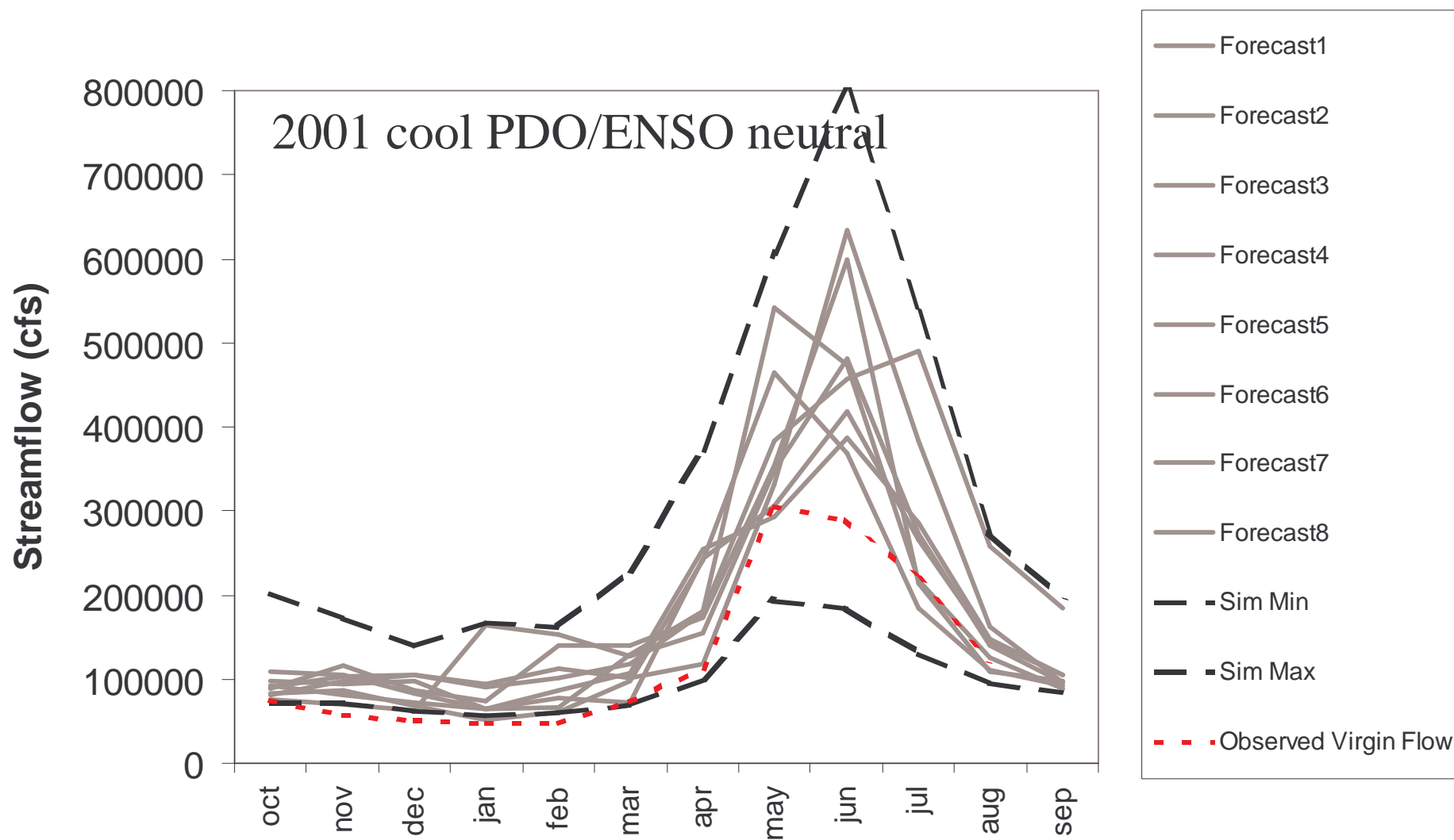
Columbia River 1/8° degree resolution

Routing Flow Network









Limitations of resampling approaches (variation of ESP)

- Class sizes become small for 3 ENSO categories x 2 PDO
- Implies that climate is stationary
- Ignores climate forecasts (e.g., climate models, CPC “official” forecasts)

N-LDAS long-term retrospective (1950-2000)

¶ VIC model implemented for 15 sub-regions, with consistent forcings.

¶ Surface forcing data:

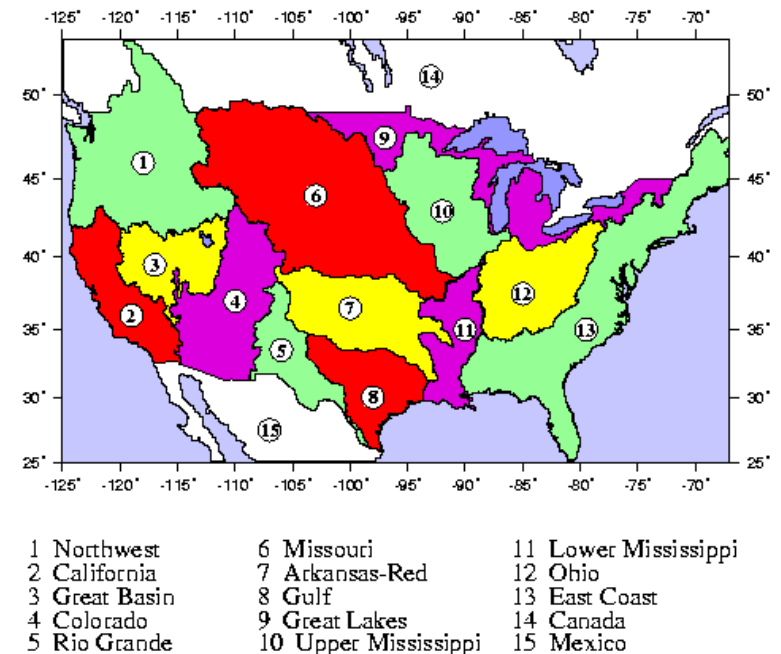
§ Daily precipitation;
maximum and minimum
temperatures (from gauge
measurements)

§ Radiation, humidity parameterized from T_{\max} and T_{\min}

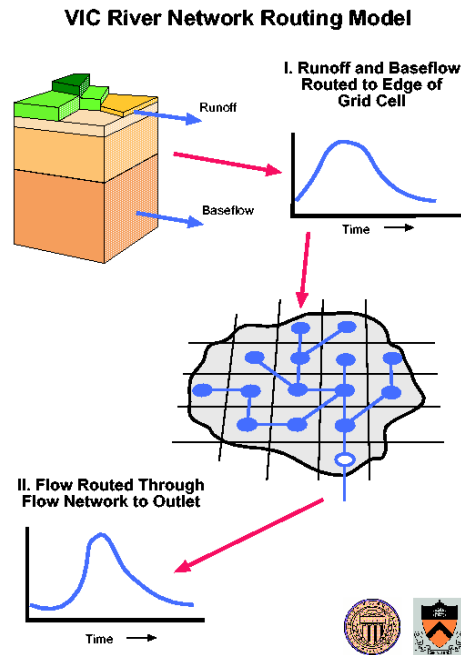
§ Wind (from NCEP/NCAR reanalysis)

¶ **Soil parameters:** derived from Penn State State STATSGO in the U.S., FAO global soil map elsewhere.

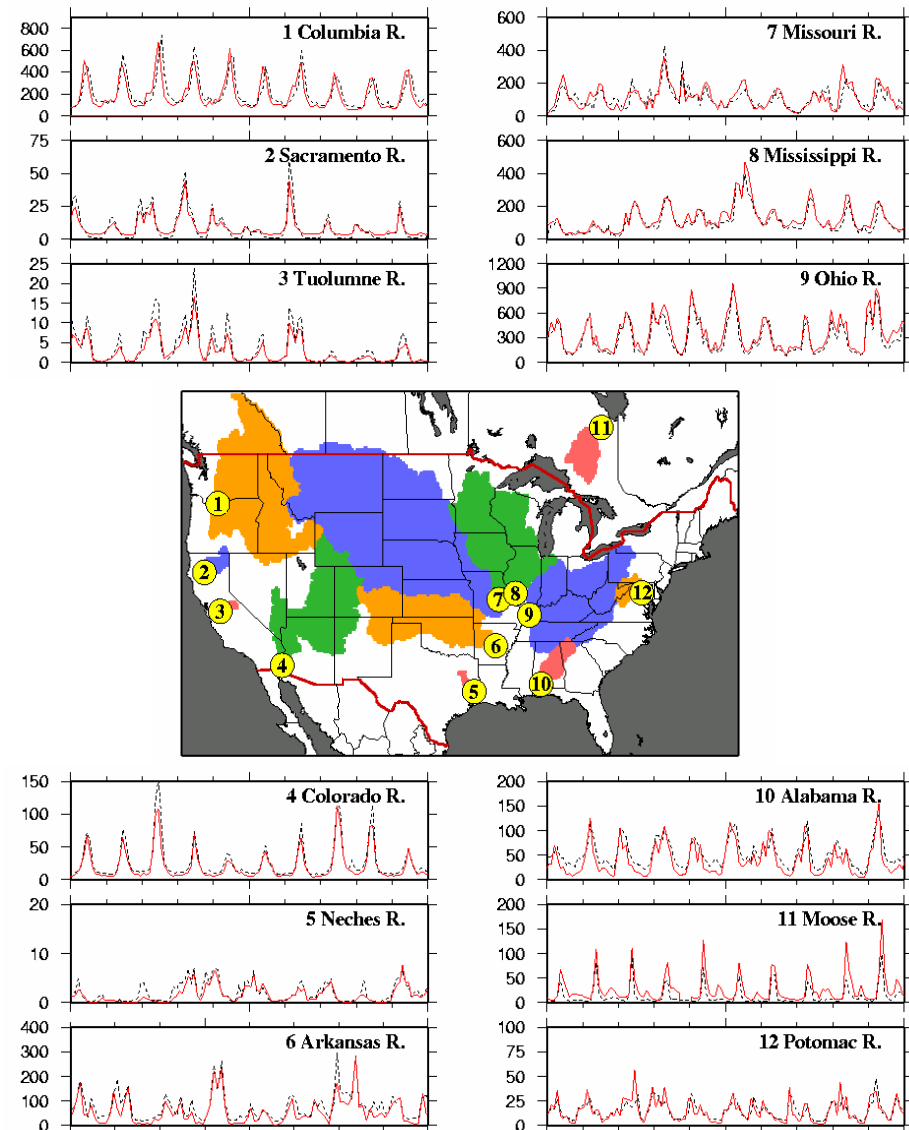
¶ **Vegetation coverage** from the University of Maryland 1-km Global Land Cover product (derived from AVHRR)



Validation with Observed Runoff



Hydrographs of routed runoff show good correspondence with observed and naturalized flows.



Current status of forecast system

Western US Forecasting Domain



- ~100 forecast points
- 6-month forecasts (12 month for CPC) issued monthly using VIC model for ESP, stratified ESP, NSIPP, NCEP/GMS
- Planned implementation of weekly updates winter 2005 (?)
- Planned implementation of multi-model hydrologic ensemble

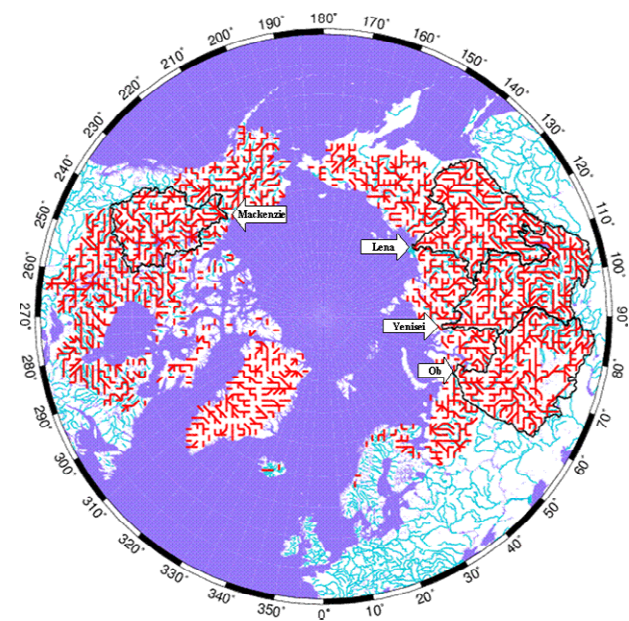
000 FXUS66 KMTR 262307 AFDMTR AREA FORECAST DISCUSSION NATIONAL WEATHER SERVICE SAN FRANCISCO CA 300 PM PST WED JAN 26 2005 .

DISCUSSION...MAIN LINE OF PRECIP HAS NOW MOVED EAST OF THE AREA BUT A FEW RESIDUAL SHOWERS REMAIN. MT HAMILTON REPORTED SMALL HAIL EARLIER THIS AFTERNOON WITH THE BAND OF SHOWERS OVER EASTERN SANTA CLARA COUNTY HILLS RIGHT NOW. FOR TONIGHT HAVE 10 [POPS](#) WITH NO MENTION OF OVERNIGHT RAINFALL. BELIEVE ANY REMAINING ISOLATED SHOWER ACTIVITY WILL QUICKLY DIE AS SUN GOES DOWN...BY 6 PM OR SO.

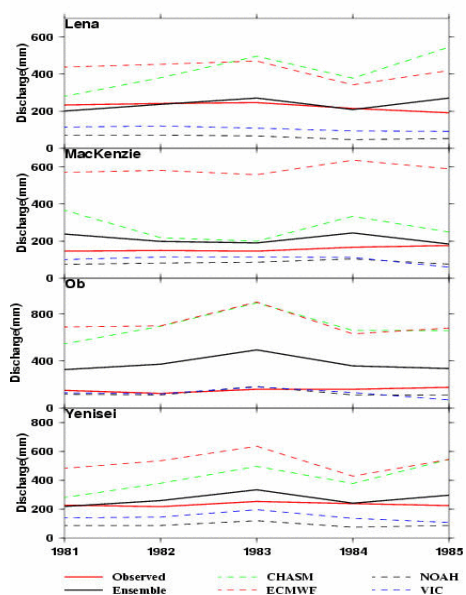
EXPECT A MOSTLY CLEAR START FOR THURSDAY (EXCEPT FOR FOG IN THE VALLEYS) AS LATEST VISIBLE IMAGERY SHOWS A DISTINCT CLEAR BREAK BETWEEN STORMS. SHOULD SEE INCREASING HIGH CLOUDS AS THURSDAY CONTINUES. [GFS](#) IS FASTER THAN THE [ETA](#) BUT BOTH BRING RAIN INTO THE [CWA](#) BETWEEN 00Z-08Z TOMORROW. AROUND THAT TIME WINDS SHOULD START TO INCREASE AS WELL. CURRENT INDICATIONS ARE NEAR WIND ADVISORY CRITERIA SO WILL MONITOR THE NEXT COUPLE OF MODEL RUNS AS WE HAVE TIME TO PULL THE TRIGGER ON THIS. RFC AND MODEL QPF INDICATES A WETTER STORM THAN TODAY'S WITH 0.25-0.50 INCHES IN THE VALLEYS AND AROUND 1.50 INCHES FOR THE HILLS ON AVERAGE. COULD BE AN UGLY EARLY MORNING COMMUTE ON FRIDAY MORNING WITH SOME OF THE HEAVIER RAINS AND STRONGER WINDS AT THAT TIME...ESPECIALLY IF THE SLOWER [ETA](#) VERIFIES. HOWEVER AT THIS TIME THE EARLIER [GFS](#) TIMING DOES APPEAR A LITTLE MORE ON TRACK. THE HAZARDOUS WEATHER OUTLOOK HAS BEEN UPDATED TO ADDRESS POTENTIAL HYDRO AND WIND CONCERNS. WORST CASE SCENARIO WOULD BE AN URBAN AND SMALL STREAM FLOOD ADVISORY ALONG WITH A LOW END WIND ADVISORY FOR THE MORNING HOURS OF FRIDAY. RAIN WILL SLOWLY CHANGE TO SHOWERS FRIDAY AFTERNOON AND FRIDAY NIGHT AS THE ENERGY HANGS BACK AS THE [TROUGH](#) SHARPENS. THEN ANOTHER WEAK SYSTEM WILL EJECT OUT OF THE PACIFIC AND KEEP THE RAIN CHANCES GOING THROUGH MUCH OF SATURDAY ESPECIALLY FOR SOUTHERN AND COASTAL SECTIONS OF THE [CWA](#).

ALL MODELS AGREE ON DRY CONDITIONS SUNDAY THROUGH WEDNESDAY AS A STRONG UPPER RIDGE BUILDS OVER THE REGION. THIS SHOULD BE A REPEAT OF LAST WEEK WHERE THE MONTEREY BAY REGION FLIRTS WITH 70 DEGREES... THE DELTA REGION IS STUCK IN THE 40S AND FOG AND THE METRO BAY AREA SEES COOL AND HAZY DAYS IN THE 50S.

Multi-model ensemble – preliminary results for pan-arctic domain

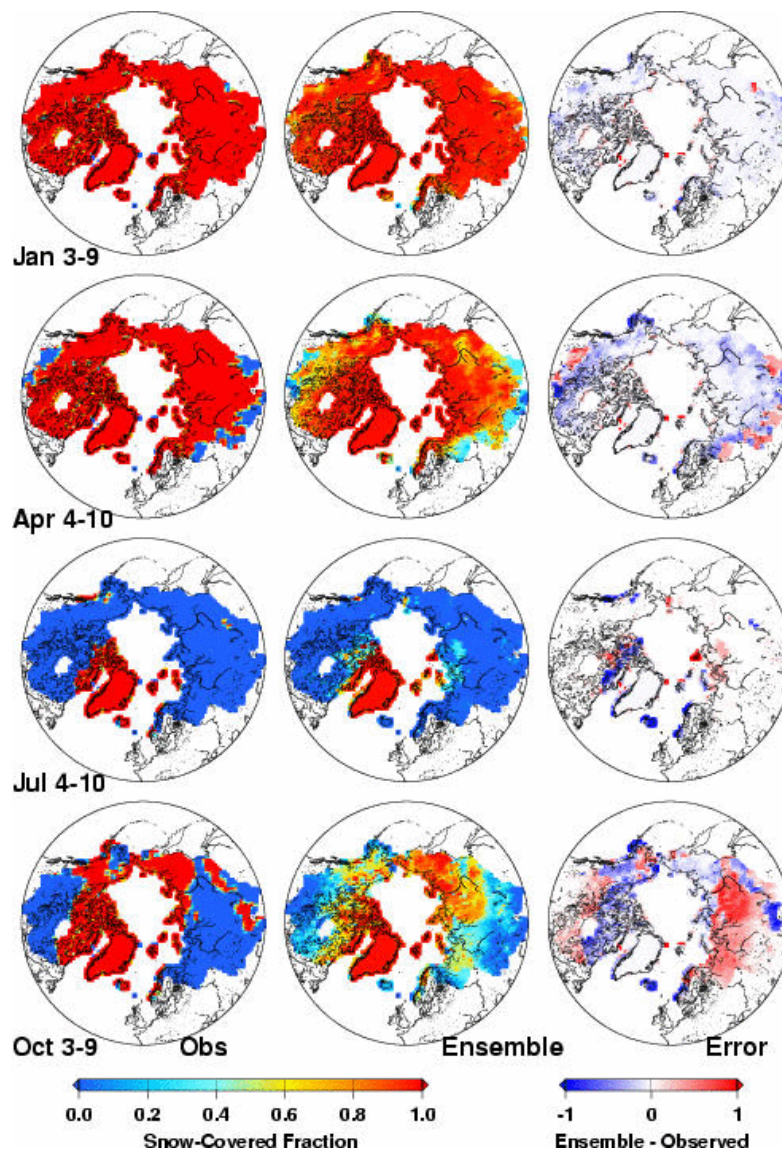


Predicted and Observed Annual Discharge, 1981-1985



Annual
simulated
discharge

Simulated and observed snow areal extent



Opportunities for collaboration

- Logistics

- Ø Data sets

- Ø Testbed (top down vs bottom up strategies)

- Ø model intercomparison

- Research

- Ø calibration (and alternatives)

- Ø Multi-model strategies

- Ø Predictability (and sources thereof)

- Ø Model physics (field validation)